

REMARKS

The Office Action of February 23, 2007 has been received and carefully considered. Applicant respectfully submits that the pending claims are not anticipated by nor obvious over the references cited by the Examiner. All claims are now present for examination and favorable reconsideration is respectfully requested in view of the following comments.

REJECTIONS UNDER 35 U.S.C. § 103:

Claims 40, 41, 43, 44 and 51 – 70 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Lehmann (US 5,651,897) in view of Kolaczkowski et al. (Kolaczkowski et al., CHEM ENGIN JOUR 73, 1999, pgs. 143-160, Wet air oxidation: a review of process technologies and aspects in reactor design), hereinafter Kolaczkowski. Claims 42 and 45 – 50 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Lehmann in view of Kolaczkowski and further in view of Sorensen et al. (US 5,370,801).

Applicant traverses the rejection and respectfully submits that the embodiments of present-claimed invention are not obvious over Lehmann in view of Kolaczkowski or further in view of Sorensen. More specifically, the inventions defined in the claims are significantly different from the disclosures of these references. There is no motivation or suggestion in the prior art that would teach the combination of these references. Even if they were combined, the combination would not teach or suggest the amended claims as presented.

Applicant believes that it will be helpful for the Examiner to understand the background of the related technology. Conventional wet oxidation is a well-known waste treatment technique. It has predominantly been applied to the oxidation of organic compounds in order to lower their chemical oxygen demand. The reaction takes place under elevated temperature and pressure in suitable apparatus which may be operated in a

batch-wise or continuous manner. The known processes all involve the removal of the treated waste from the reactor in the liquid phase. Known processes that incorporate a liquid/vapour separation merely do so to remove unreacted components of the oxidation gas from the liquid effluent removed from the reactor.

The waste to be treated will generally comprise a mixture of organic compounds which leads to an inherent limitation in the known processes because the different compounds will oxidize at a different rate. Therefore, the rate at which waste may be treated is limited to the rate at which the most oxidation-resistant compound is oxidized. Alternatively, the degree to which the chemical oxygen demand of the waste is lowered must be sacrificed to achieve faster throughput of the waste. Therefore, to achieve faster oxidation in conventional wet oxidation processes, either the reaction temperature must be increased or a transition metal catalyst used. The use of an increased reaction temperature leads to higher capital costs and various safety issues. The use of a catalyst to increase the rate of reaction in the known processes is not convenient, because the wet oxidation products are removed in the liquid phase and, therefore, the catalyst will be present in the product stream. This leads to additional disposal issues.

As explained on page 154 of Kolaczkowski., the disadvantage of the use of a catalyst in a conventional wet oxidation process, including the Zimpro process, is that the catalyst must be recovered from the liquid effluent or discarded. The additional processing required to recover the catalyst “has an adverse effect on capital costs.” In relation to homogeneous catalyst systems, Kolaczkowski concludes on page 158 that:

“... there is a need to develop a more effective integrated technique for wet air oxidation and simultaneous recovery and recycle of the metal catalyst from the treated effluent.”

Applicant has developed the present process in which only a vapour phase product stream is removed from the reactor during the wet oxidation (see Claim 40, “a vapor phase comprising at least some oxidation products”). This provides two significant advantages over prior art processes. Firstly, compounds that are more susceptible to oxidation will react quickly to give volatile products which are removed in the vapour

phase as they are formed. More stable substances, which have a correspondingly slower rate of reaction, will remain in the reactor until they have oxidized to volatile products. Therefore, the rate at which waste may be treated is no longer limited to the rate at which the most oxidation-resistant compound reacts. Secondly, because the liquid phase is retained in the reactor and not discharged, a catalyst may be used to increase the rate of reaction. The catalyst can treat multiple volumes of feedstock, which are introduced into the reactor as the volatile wet oxidation products are removed in the vapour phase. The catalyst is retained in the reactor and does not exit with the oxidation products removed in the vapour phase.

Regarding the Examiner's rejections to Claims 40, 41, 43, 44 and 51-70, it is respectfully submitted that Lehmann (US 5,651,897) is directed to a variation of the Zimpro process. The Zimpro process was originally developed in the 1930s and is discussed generally on pages 149-150 of Kolaczkowski. The Zimpro process results in a liquid effluent stream, which requires downstream processing, exiting the wet oxidation reactor. Lehmann describes a wet oxidation process that is directed to generating a high solids content effluent stream from a high strength waste water. The process involves diluting the high strength waste water with a mixture comprising a portion of the liquid effluent from the reactor and a portion of the condensate from the vapour phase effluent from the reactor. This process provides a sufficiently diluted feedstock to enable effective temperature control and also provides a high solids content effluent stream which is desirable for recovery or disposal of the solids.

In the process described in Lehmann, both an oxidized liquid phase and a gaseous phase are withdrawn from the reactor. There is no teaching in these documents of a continuous process in which oxidation products are removed from a reactor exclusively in the vapour phase as in the present invention (see Claim 40, step c) "continuously removing at least some of the vapour phase comprising at least some oxidation products from the reactor while retaining the liquid phase in the reactor"). In addition, Lehmann does not disclose or even suggest the use of a catalyst in the wet oxidation process taught therein (see Claim 40, step b)).

The Examiner alleges that, in view of the teachings of Kolaczkowski it would have been obvious to modify the process of Lehmann by using a catalyst to enhance the reaction rate in the reactor. According to MPEP 2143.01, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). According to MPEP 2143.03, to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Applicant respectfully submits that, in light of the extensive development of the Zimpro process, the absence of even a suggestion in Lehmann to use a catalyst and the conventional understanding of the **disadvantages** of using a catalyst in conventional wet oxidation processes, this alleged combination of Lehmann and Kolaczkowski is inapposite and cannot be envisioned by a person of ordinary skill in the art. The Examiner also alleges that the use of flash evaporation to remove the vapour phase would have been an obvious matter or process optimisation to one skilled in the art depending on the specific reactor utilized and results desired. Applicant respectfully submitted that the Examiner has not provided any evidence to support this assertion and a *prima facie* case of obviousness has not been established. As explained above, conventional wet oxidation processes result in the formation of a liquid effluent that exits the reactor. Continuously removing the oxidation products in the vapour phase, whether by flash vaporization or some other method, is **not** merely a matter of process optimization **but** represents a fundamental difference between the process claimed in this application and those described in the prior art. Therefore, Applicant respectfully submits that the claims of this application are not rendered obvious by the combination of citations relied upon by the Examiner.

Regarding rejections to Claims 42 and 45-50, Sorensen (US 5,370,801) discloses a conventional wet oxidation process utilizing a turbulent flow tubular reactor operated in a plug-flow manner. Such a reactor requires that the flow rate be adjusted such that the waste has sufficient residence time in the reactor to oxidize the most stable compound. Therefore, the disclosure of Sorensen does not overcome the deficiencies of the other references cited by the Examiner, which are discussed above. Claims 42 and 45-50 all include the limitations of Claim 40. Therefore, these claims are not obvious over the citations relied upon by the Examiner. In addition, Applicant respectfully submits that Sorensen reflects the conventional approach to the use of catalysts in conventional wet oxidation processes. Column 10 of Sorensen at lines 10-13 teaches that:

“...the catalyst may be difficult to recover from the wet oxidation treated material and consequently may be lost from the system when the wet oxidation treated material is removed.”

In summary, Claim 40 of the present application is directed to a wet oxidation process in which the oxidation is carried out as a continuous process with the feedstock being contacted with an oxidant, in a reactor, in the presence of a catalyst to give a vapour phase which comprises volatile oxidation products and which is continuously removed from the reactor. The Examples of the present specification illustrate processes which utilize these features. Applicant respectfully submits that there is no disclosure or suggestion in prior art of a continuous wet oxidation process in which oxidation products are removed from the reactor exclusively in the vapour phase. This, combined with the use of a catalyst, provides a process, which offers significant advantages over those of the prior art. In summary, the applicants submit that the wet oxidation process of the present invention is inventive over the prior art relied upon by the Examiner. Applicant respectfully submits that no hindsight gained from the present application should be used in analyzing the obviousness of the combination of relevant references.

Thus, the newly presented claims are not obvious over Lehmann in view of Kolaczkowski or further in view of Sorensen. The rejection under 35 U.S.C. § 103 has been overcome. Accordingly, withdrawal of the rejections under 35 U.S.C. § 103 is respectfully requested.

Having overcome all outstanding grounds of rejection, the application is now in condition for allowance, and prompt action toward that end is respectfully solicited.

Respectfully submitted,

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